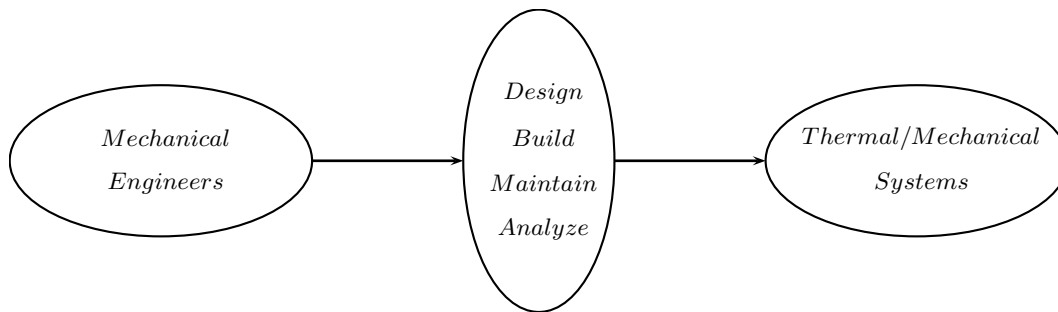


# ME 301: Structure and Properties of Solids, Spring Semester 2009

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## Purpose of Course

In general, mechanical engineers will have careers that focus on designing, building, maintaining and analyzing thermal and mechanical systems and devices. A thorough knowledge of the materials that are used in these engineering systems is necessary to be a competent engineer.



At this point in your engineering career, you should be familiar with a number of properties of solid materials such as density, thermal and electrical conductivity, and specific heat. In addition, you may be familiar with a number of engineering properties of materials such as yield strength, hardness, and ductility. These "macroscopic" material properties are all determined by the "microscopic" properties of the material on an atomic level. For example, the yield strength of any steel alloy is dependent on:

1. the electronic configuration of iron and carbon,
2. the electronic configuration of any other alloying elements present in the steel,
3. the crystal structure of the steel at its temperature of use,
4. the type(s) and number of defects in the crystal lattice of the steel,
5. the process by which the steel was solidified from the liquid state,
6. any subsequent heat treatment of the steel after solidification, and
7. any cold-working that the steel has undergone.

In this course, you will be illuminated as to how these "macroscopic" properties are connected to and determined by the "microscopic" properties of engineering materials.

## Course Topics

The following is a list, by no means exhaustive, of some of the topics that you will be expected to master by the end of this semester:

1. The electronic structure of atoms and how it controls the types of bonding that exist in solids.
2. How electrons bond in metals and how this effects their crystalline structure.
3. The processes of homogeneous and heterogeneous solidification.
4. Diffusion of atoms in solids due to concentration and temperature gradients.
5. The definitions of strength, hardness and ductility in metals and how they are controlled in engineering alloys.
6. How metals fail by ductile and brittle fracture, fatigue, creep and corrosion and how to avoid these types of failure.
7. The use of phase diagrams to determine the microstructure of metallic alloys.
8. The processing methods which are used to produce the metallic elements and alloys that you will encounter as engineers.

## Assignments

Your mastery of the topics covered in class will be assessed based on the following assignments and examinations with their respective weighting:

1. 15% - Weekly homework sets assigned each wednesday and due the following wednesday.
2. 15% - Weekly quizzes at the beginning of the class on each wednesday.
3. 40% (20% x2) - Two midterm examinations during the semester: February 18th, and April 1st.
4. 30% - One comprehensive final exam on May 4, 2009 at 1 p.m.

## Grading

The final grade assigned to you will be calculated using the following scale:

93	≤	A		
90	≤	A <sup>-</sup>	<	93
87	≤	B <sup>+</sup>	<	90
83	≤	B	<	87
80	≤	B <sup>-</sup>	<	83
77	≤	C <sup>+</sup>	<	80
73	≤	C	<	77
70	≤	C <sup>-</sup>	<	73
67	≤	C	<	70
63	≤	C	<	67
60	≤	C	<	63
		F	<	60

**Text** "Foundation of Materials Science and Engineering", W.F.Smith and J.Hashemi, 4th Edition.

## Schedule of Class Activities, Topics, and Reading Assignments

Week	Monday	Wednesday
1	1/12 - Preliminaries	1/14 - Introduction: Chap. 1
2	1/19 - Holiday	1/21 - Atomic Structure: 2.1 - 2.3
3	1/26 - Bonding: 2.4 - 2.7	1/28 - Bonding: 2.8 - 2.10
4	2/2 - Crystal Structure: 3.1 - 3.5	2/4 - Crystal Structure: 3.6 - 3.10
5	2/9 - Solidification: 4.1 - 4.2	2/11 - Crystalline Imperfections: 4.3 - 4.4
6	2/16 - Holiday	2/18 - 1st Midterm: Chapters 1-4
7	2/23 - Diffusion in Solids: 5.1 - 5.2	2/25 - Diffusion in Solids: 5.3 - 5.4
8	3/2 - Mechanical Properties of Metals I: 6.1	3/4 - Mechanical Properties of Metals I: 6.2-6.5
9	3/9 - Mechanical Properties of Metals I: 6.6-6.10	3/11 - Mechanical Properties of Metals II: 7.1-7.3
10	3/16 - Mechanical Properties of Metals II: 7.4-7.5	3/18 - Mechanical Properties of Metals II: 7.6-7.7
11	3/23 - Phase Diagrams: 8.1-8.4	3/25 - Phase Diagrams: 8.5-8.8
12	3/30 - Phase Diagrams: 8.9-8.12	4/1 - 2nd Midterm: Chapters 1-8
13	4/6 - Spring Break	4/8 - Spring Break
14	4/13 - Engineering Alloys: 9.1-9.4	4/15 - Engineering Alloys: 9.5-9.8
15	4/20 - Engineering Alloys: 9.9-9.12	4/22 - Corrosion: 13.1 - 13.4
16	4/27 - Corrosion: 13.5 - 13.7	4/29 - Semester Review

## My Expectations

I have the following expectations of you, the students, who are enrolled in this class:

1. You are here to learn.
2. You are going to behave as adults.

If either of these two statements are not true, then you should seriously consider dropping this class immediately.

## General University Policies

**Academic Misconduct** - "Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility and professionalism. By choosing to join the UNLV community, students accept the expectations of the Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling in UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution." An example of academic misconduct is plagiarism: "Using the words or ideas of another, from the Internet or any source, without proper citation of the sources." See the "Student Academic Misconduct Policy" (approved December 9, 2005) located at: <http://studentlife.unlv.edu/judicial/misconductPolicy.html>.

**Copyright** - The University requires all members of the University Community to familiarize themselves and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. To familiarize yourself with copyright and fair use policies, you are encouraged to visit the following website: <http://www.unlv.edu/committees/copyright/>.

**Disability Resource Center (DRC)** - The Disability Resource Center (DRC) coordinates all academic accommodations for students with documented disabilities. The DRC is the official office to review and house disability documentation for students, and to provide them with an official Academic Accommodation Plan to present to the faculty if an accommodation is warranted. Faculty should not provide students accommodations without being in receipt of this plan. UNLV complies with the provisions set forth in Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, offering reasonable accommodations to qualified students with documented disabilities. If you have a documented disability that may require accommodations, you will need to contact the DRC for the coordination of services. The DRC is located in the Student Services Complex (SSC), Room 137, and the contact numbers are: Voice (702) 895-0866, TTY (702) 895-0652, fax (702) 895-0651. For additional information, please visit: <http://studentlife.unlv.edu/disability/>.

**Missed Class(es)/Student** - As a general rule, a student missing a class or laboratory assignment because of observance of a religious holiday shall have the opportunity to make up missed work. Students must notify the instructor of anticipated absences by the last day of late registration, January 16, 2009, to be assured of this opportunity. Faculty may give students an additional week, but are encouraged to set a clear deadline. NOTE: Students who represent UNLV at any official extracurricular activity shall also have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to the missed class(es).

This policy shall not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the university that could reasonably have been avoided. There should be good faith effort by both faculty and student to come to a reasonable resolution. When disagreements regarding this policy do arise, they can be appealed to the department chair/unit director, college/school dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to; band, drama, intercollegiate athletics, recruitment, and any other activity sanctioned by a college/school dean, and/or the Executive Vice President and Provost.

**Rebelmail** - By policy, faculty and staff should e-mail students' Rebelmail accounts only. Rebelmail is UNLV's official e-mail system for students. It is one of the primary ways students receive official university communication. All UNLV students receive a Rebelmail account after admission to the university. Non-admitted students should contact the Student Help Desk at (702) 895-0761, in the Student Union Room 231, or by e-mail: [studenthelp@unlv.edu](mailto:studenthelp@unlv.edu). See <http://rebelmail.unlv.edu/> for additional information.

**UNLV Writing Center** - One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>